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Their Minds Will Follow: Big Business and California Higher Education, 1954-1960

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Scholars from various disciplines have assessed the relationship between academia and industry, particularly in recent years, when the rise of the knowledge economy coincided with a greater emphasis on the university's role in economic development. This paper is about the role that engineering education played in the turf battle between the University of California and the state colleges that preceded California's Master Plan for Higher Education. It is about external influences on the supply and demand for engineering education in California. Regarding supply: It is about the role that a private university (Stanford University) played in the direction that public higher education would take. Regarding demand: It is about the irony that organizations headquartered elsewhere could help catalyze the reshaping of California's system of higher education. Finally, it is about how the combination of supply and demand forces led to creation of the engineering program at San Jose State and its subsequent expansion of scope.

In the spring of 1959, the University of California, Berkeley, quietly announced the demise of a graduate engineering program located in the region that would later become known as Silicon Valley. Enrollment had been sparse: nine students enrolled in the spring after seven had completed the program's only course in the fall of 1958.[1] Given the paltry

[1] B. Bresler to M. P. O'Brien, 20 Feb. 1959, CU-149, box 40, folder 5, University of California Archives, Bancroft Library, University of California, Berkeley; Stephen

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enrollment numbers, one would never guess that the demand for this modest program, and the response to that demand, had stirred powerful forces in business, politics, and higher education in postwar California. One would never guess that debate over the program had cost the dean of engineering his job and been the centerpiece of a controversy over engineering education that culminated in California's Master Plan for Higher Education, which was approved in the spring of 1960.[2] One would never guess that key players in the drama over this small program recognized something big: that individual academic institutions were on their way to becoming engines of economic development on a larger order of magnitude than most countries.[3]

Scholars from various disciplines have assessed the relationship between academia and industry, particularly in recent years, when the rise of the knowledge economy coincided with a greater emphasis on the university's role in economic development. Roger Geiger devoted an entire volume, *Knowledge and Money*, to the third mission and university response to market forces since 1980.[4] Burton Clark referred to academic institutions responding to such forces as "entrepreneurial" universities.[5] Henry Etzkowitz has dubbed the university-government-industry nexus as the "Triple Helix."[6] Scott Shane has analyzed the changes in law (especially the Bayh-Dole Act) in the expansion of university revenue sources.[7] Stuart Leslie and Rebecca Lowen note the impact of

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B. Adams, "Follow the Money: Engineering at Stanford and UC Berkeley during the Rise of Silicon Valley," *Minerva* 47 (2009): 386.

[2] Clark Kerr, *The Gold and the Blue: A Personal Memoir of the University of California*, vol. 1 (Berkeley, Calif., 2001), 182; John Aubrey Douglass, *The California Idea and American Higher Education: 1850 to the 1960 Master Plan* (Stanford, Calif., 2000); Neil J. Smelser, "Growth, Structural Change, and Conflict in California Public Higher Education, 1950-1970," in *Public Higher Education in California*, ed. Smelser and Gabriel Almond (Berkeley, Calif., 1974), 9-141.

[3] Jonathan R. Cole, *The Great American University: Its Rise to Preeminence, Its Indispensible National Role, and Why It Must Be Protected* (New York, 2009), 196-97; Edward B. Roberts and Charles Eesley, *Entrepreneurial Impact: The Role of MIT* (Kansas City, Mo., 2009); James F. Gibbons, "The Role of Stanford University: A Dean's Reflections," in *The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship*, ed. Chong-Moon Lee et al. (Stanford, Calif., 2000), 200-205.

[4] Roger L. Geiger, *Knowledge & Money: Research Universities and the Paradox of the Marketplace* (Stanford, Calif., 2004).

[5] Burton R. Clark, *Creating Entrepreneurial Universities: Organizational Pathways of Transformation* (New York, 1998).

[6] Henry Etzkowitz, *The Triple Helix: University-Industry-Government Innovation in Action* (New York, 2008).

[7] Scott Shane, *Academic Entrepreneurship: University Spinoffs and Wealth Creation* (Northampton, Mass., 2005).

entrepreneurial efforts by private universities (Stanford for both, MIT for Leslie) on curriculum priorities, research agendas of professors, and the experiences of students.[8] Clark Kerr wrote about how one of the distinctive aspects of the American university was its engagement with a variety of external influences.[9] As president of the University of California, Kerr had first-hand experience with external influence in the years before he became primary architect of the Master Plan.

This essay is about the role that engineering education played in the turf battle between the University of California and the state colleges that preceded the Master Plan. It is about the role of external influences on the supply of and demand for engineering education in California. Regarding supply, the paper is about how the state of California addressed the university's third mission (economic development), and in so doing needed to reconsider the university's other two missions (teaching and research). It is about the role that a private university (Stanford University) played in the direction that public higher education would take. It is about how the combination of supply and demand forces led to creation of the engineering program at San Jose State and its subsequent expansion of scope. Regarding demand, the essay is about whose requests for graduate programs in engineering mattered and why. It is about the irony that organizations headquartered elsewhere could help catalyze the reshaping of California's system of higher education.

The Supply of Engineering Education

The 1940s and 1950s represent a watershed in engineering education in the state of California. When the United States entered World War II, the University of California, Berkeley, was the state's only public institution granting a bachelor's degree in engineering. The national engineering accrediting body, the Engineering Council of Professional Development (ECPD), was less than ten years old.[10] The landscape for engineering education in California changed quickly. In 1942, the California Polytechnic College (Cal Poly) at San Luis Obispo became the first state college to grant an engineering degree. UCLA received permission to begin an engineering program in 1943, and hired one of UC Berkeley's top faculty members (L. M. Boelter) as its first dean. A few years later, Fresno, San Diego, and San Jose State Colleges were granting B.S. degrees in

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[8] Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York, 1993); Rebecca S. Lowen, *Creating the Cold War University: The Transformation of Stanford* (Berkeley, Calif., 1997).

[9] Clark Kerr, *The Uses of the University* (Cambridge, Mass., 2001), 20.

[10] "The Engineers' Council for Professional Development," *Science* 94 (Nov. 1941): 456.

engineering and seeking to conduct research, to grant master's degrees, and to pursue accreditation.[11]

The postwar period was one of dramatic population and economic growth in California: in the 1950s alone the state's population increased about 50 percent.[12] No discipline was more closely identified with the state's postwar growth than engineering, especially during a decade when $50 billion came to the state in defense spending.[13] By 1958, California would have ten state-supported engineering programs.[14] How to adequately serve employers of engineers—especially in defense-related industries—became a central question for California higher education and would be in the forefront of debates preceding the Master Plan.

The proliferation of engineering programs in California was part of a broader trend. During the 1940s and 1950s, more than one hundred state colleges across America were in the midst of a transformation from their roots as normal schools to teachers' colleges to universities.[15] That meant a broadening of scope to include professional training for fields such as business, nursing, law enforcement—and engineering. UC president Robert Gordon Sproul had warned in the 1930s of the desire of the existing state colleges to expand their scope. "Some teachers colleges, far from emphasizing the professional work that is theirs to do, would hide in every way possible, even to the suppression of their legal names, the fact that they have anything to do with teachers."[16] Representatives of the university had genuine fears about what the state colleges were up to. By the end of World War II, nearly half the students in California's onetime teachers' colleges would major in something besides teaching.[17]

UC behaved like a monopolist, attempting to protect its position as California's public research university and producer of Ph.D.'s, and the privileged access to scarce resources accompanying that distinction. By contrast, the state colleges behaved like entrepreneurs, constantly seeking opportunities for upward mobility—mobility that promised graduate programs and greater prestige and that would require more resources.

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[11] Robert A. Vivian, "Report on Engineering Education in the State Colleges," 1 June 1962, section V: "Growth of Engineering Education in California," box MC 193, binder labeled GSBA Eng. . . . 1956-1968," San Jose State University, Archives, San Jose, Calif. [hereafter, SJS Archives].

[12] Kevin Starr, *Golden Dreams: California in an Age of Abundance, 1950-1963* (New York, 2009), x.

[13] Starr, *Golden Dreams*, 227.

[14] O'Brien to Strong, 6 Oct. 1958, CU-149, box 40, folder 23.

[15] Kevin Carey, "The Dangerous Lure of the Research-University Model," *Chronicle of Higher Education* (25 Feb. 2011), A32.

[16] Robert Gordon Sproul, Inaugural Address, 22 Oct. 1930, p. 14; URL: http://bancroft.berkeley.edu/CalHistory/inaugural.sproul.html.

[17] Douglass, *The California Idea*, 156.

This tension was exacerbated by the governance structures under which the University of California and the state colleges operated. UC reported to a Board of Regents whose sole mission was to govern the university. While maintaining constitutional independence from the state legislature, the university was beholden to the Regents, and as the system grew beyond one campus there would be little latitude for each campus to freelance. The state colleges, by contrast, reported to the California Board of Education. The primary concern of the Board of Education was the K-12 system; its other responsibilities overwhelmed this bureaucracy, which had insufficient bandwidth to carry out its complete mission; therefore, the state colleges were subject to very little oversight.[18]

That reporting relationship and relative lack of supervision was an invitation for entrepreneurial behavior by the state colleges. The result was a ritual, as recalled by Sproul's successor as UC president, Clark Kerr: "The state colleges came in with their demands for expanded programs. The university usually voted 'no.' Then the state colleges, if at all possible, found a way around the 'no' by one subterfuge or another."[19]

In 1945, governor Earl Warren demanded planning and coordination in California higher education, and a Liaison Committee was created, consisting of representatives of the University's Board of Regents and the California Board of Education.[20] The new committee commissioned education consultant George Strayer to conduct a study of California higher education.[21] "A Survey of the Needs of California in Higher Education" concluded that the state colleges should not be limited to teacher education but instead should offer a "wide variety of curricula." In 1949, the legislature followed the report's suggestion of allowing the state colleges to offer master's degrees—but only in teacher education. This meant that it was OK for the colleges to offer master's degrees in fields taught at the high school level such as English and history. It was not OK for the state colleges to offer master's-level professional programs where the graduates were expected to pursue other occupations, such as engineering.[22]

During the 1950s, top research universities shaped the discipline of engineering in many ways, from manning accreditation committees to training those who would become faculty members. The result was a pyramid in which the top level (which Kevin Carey dubs the "academic

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[18] Arnold Joyal, oral history, container OHP003, ID 10825, p. 8, California State University Archives Oral History Project, California State University, Dominguez Hills.

[19] Kerr, *The Gold and the Blue*, 175.

[20] Douglass, *The California Idea*, 179.

[21] Ibid., 185.

[22] James Enochs, oral history, container OHP012, ID 10940, p. 14, California State University Archives Oral History Project, California State University, Dominguez Hills; Douglass, *The California Idea*, 187.

city-state, the palace of learning on a hill"), trained more people than were required to replace those who retired.[23] Many of the rest would end up at state colleges, to which they brought the sensitivity they had cultivated in graduate school, which included an appreciation for and desire to conduct research. The inevitable result was pressure from within the faculty ranks of the state colleges to become more like research universities, with the associated increase in prestige and decrease in teaching loads.

In California, nearly 40 percent of the engineering faculty of state colleges had received their training at Stanford or UC Berkeley. The influence of those programs on engineering at the state colleges was even greater than that. In 1945, Frederick Terman became dean of engineering at Stanford. Terman would not only represent a formidable competitor to UC Berkeley's dean of engineering, M. P. "Mike" O'Brien, but would also become a sought-after arbiter of excellence of other programs, including those at the University of California and in the state college system.[24] The opinion of Terman, who would become known as the "Father of Silicon Valley" for his outreach efforts to high-tech industry, would matter in the 1950s, when he weighed in on the question of limiting the size and scope of state college engineering programs.

At times, it seemed as if the state colleges were mortal pawns in a battle between the engineering gods at Stanford and UC Berkeley. The god at Stanford (Terman) consistently supported efforts by the state colleges (especially San Jose State) to expand their scope and enhance their reputations. The god at Berkeley (O'Brien) would consistently oppose efforts by the state colleges to expand their scope. O'Brien saw the state colleges as competitors for funding from the state budget for higher education, so he was adamant that they not infringe on roles played by UC. Therefore, when third parties reviewed or reported on engineering in the state colleges, particularly relating to accreditation or the ability to offer master's degrees, the extent to which Terman or O'Brien was involved could make all of the difference in the outcome.

Stanford's welcoming attitude for newcomers in engineering was a reflection of Terman's strategy and of the university's limited resources, which dictated pursuit of a niche strategy rather than a comprehensive approach.[25] Terman anticipated (and encouraged) the proliferation of high-tech industry in the Santa Clara Valley near Stanford. He realized that, in addition to the research his Ph.D. graduates performed, engineers with master's and bachelor's degrees would play big roles in the region's

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[23] Carey, "The Dangerous Lure of the Research-University Model," A32.

[24] Adams, "Follow the Money."

[25] Stephen B. Adams, "Stanford University and Frederick Terman's Blueprint for Innovation in the Knowledge Economy," in *The Challenge of Remaining Innovative: Insights from Twentieth-Century American Business*, ed. Sally H. Clarke, Naomi R. Lamoreaux, and Steven W. Usselman (Stanford, Calif., 2009), 169-90.

development: "Our society demands suitable personnel for each level, and the schools, colleges and universities must meet that demand."[26] Harold Hayes, the dean of engineering at Cal Poly San Luis Obispo, the state colleges' premier engineering institution, agreed, noting that such "practitioners" carried "the burden of day-to-day engineering in the nation," and that training them was the role of the state colleges.[27]

A rule of thumb at the time, which Terman followed, was: for every engineer with a Ph.D. degree, there should be four engineers with master's degrees, twenty with bachelor's degrees, and forty technicians.[28] Instead of twenty bachelor's degrees for each Ph.D., however, Stanford's engineering program produced closer to three bachelor's degrees per two Ph.D.'s. This meant that to achieve what Terman saw as a proper balance in meeting the needs of the local region, Stanford would need help in producing engineers with bachelor's degrees. That is what Terman hoped essentially to outsource to colleges such as San Jose State, which was "to a lesser degree oriented toward teacher education" than the other state colleges, according to Fresno State's president Arnold Joyal.[29]

In a sense, San Jose State's engineering school owed its existence to Stanford University. Engineering at San Jose State began with the initiative of president Thomas MacQuarrie. MacQuarrie had been a student of the Stanford psychology professor Lewis Terman, the father of Silicon Valley's father. In 1943, MacQuarrie decided to investigate opportunities in "practical engineering." San Jose State retained Guido Marx, an emeritus professor of engineering at Stanford, to survey programs at other schools and determine if it made sense for San Jose State to establish a "practical training program . . . that would differ from that of the University of California."[30] Fred Terman would have been the natural individual to ask, but during World War II he was running the Radio Laboratory at Harvard and had brought several key engineering faculty with him—hence Marx took the lead regarding the new program. Two of the three committee members were from Stanford (the third was from San Jose State). Ralph Smith, an assistant professor of electrical engineering (and a former Ph.D. student of Terman), was the other Stanford representative.

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[26] Terman et al., "Report on Engineering Education in the California State Colleges," June 1952, binder labeled "Historical Data Eng. Education . . . 1946-1955," SJS Archives.

[27] Hayes to W. J. Adams, 21 Jan. 1959, Santa Clara University Archives [hereafter, SCU Archives].

[28] "A Restudy of the 1953 Engineering Agreement," Part II, CU-149, box 40, folder 5.

[29] "Arnold Joyal: A Presidential View of the Master Plan," interviewed by Lawrence B. de Graaf (Fullerton Oral History Program, 1987), 12.

[30] Interview with Thomas W. MacQuarrie, 16 Feb. 1956, from "Oral History Project: San Jose State College Centennial History," compiled by Benjamin Franklin Gilbert, LD 729.6 S4 G55x 1957, SJS Archives.

The result of Marx's study was that, in June 1944, the San Jose State President's Council decided to proceed with an engineering program. In September, San Jose State hired Ralph Smith to head up the program. Smith spent much of the fall of 1944 visiting twenty-two engineering institutions. During 1945, he designed a curriculum, and San Jose offered its first engineering classes in January 1946. Later that year, quonset huts appeared on campus—the first home for the new engineering program.[31] In December, the San Jose State Council discussed the prognosis for the nascent program and decided to continue.[32]

In 1948, San Jose State awarded its first engineering degree. The following year, President MacQuarrie was instrumental in obtaining a legislative appropriation of $250,000 for a new engineering building. Five years later, San Jose State would hold a formal ceremony dedicating the new building. In addition to the incumbent leaders and internal individuals responsible for the program's inception and advance, a number of external individuals spoke. Only one of them was from a university, and that was Fred Terman—representing Stanford.[33] Terman's presence at the ceremony acknowledged the debt that San Jose State's engineering program owed to its neighbor.[34]

Terman's absence could also make a big difference. This was never more evident than in the efforts of Cal Poly San Luis Obispo to gain accreditation by the ECPD in 1949. Cal Poly had transformed itself from a junior college into a four-year college during the presidency of Julian McPhee, which began in 1933. The three-person accreditation team, chaired by Dean Gordon M. Butler from the University of Arizona, and including Dean Herbert S. Evans from the University of Colorado and

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[31] Interview with Ralph Smith, 10 March 1956, "Oral History Project: San Jose State College Centennial History," compiled by Benjamin Franklin Gilbert. LD 729.6 S4 G55x 1957, SJS Archives.

[32] Minutes, SJSC Council, 10 Dec. 1946, box AG 16, binder titled "SJSC Council 1946-1952," SJS Archives.

[33] Little wonder that during a 1952 visit to San Jose State, O'Brien acknowledged that one of the possible consequences of a lack of agreement between UC and the state colleges would be the state colleges becoming "aligned with the private Colleges S.C. and Stanford." ["Meeting with O'Brien," 24 Nov. 1952, MC 195 binder titled "Staff Meetings 1955 . . . State College-UC Controversy].

[34] In March 1958, San Jose State's division of engineering requested approval for a new curriculum for a master's degree in electrical engineering—the primary bone of contention in the previous years. The proposal listed five faculty members "interested and capable of teaching graduate course work." Of the five, three had Ph.D.'s (all from Stanford), and two had M.S. degrees (one from Stanford). Request for Approval . . . March 1958, MC 193 binder labeled "Accreditation . . . Lab Sizes 1956-1958."

Dean Terman, was originally scheduled to visit Cal Poly on December 26 and 27, 1949.[35]

President McPhee petitioned Governor Warren (UC class of 1912) for funds to cover the associated costs of an accreditation application. At that point the UC Alumni Association swung into action. As Cal Poly's history notes, "The Alumni Association was able to hold up the release of the emergency funds long enough to allow pressuring of ECPD to remove Dr. Terman from the visitation committee and to replace him with Dean O'Brien, University of California, Berkeley. Dean Terman was known to be sympathetic to the efforts in engineering education of the [Cal Poly] electrical engineering department."[36]

The committee finally visited Cal Poly on April 14, 1950. The decision, which would be announced in October, was to deny accreditation.[37] Dean Butler cast a no vote. Dean Evans voted yes. Dean O'Brien voted no. The Cal Poly history continues: "It was learned some months later that a California Alumni Association staff person helped Dean Butler write the final report of the committee on Saturday, April 15 in the Biltmore Hotel in Los Angeles."[38] UC's role in blocking the accreditation of Cal Poly San Luis Obispo discouraged McPhee, who would not seek accreditation again during his presidency, which ended in 1966. Cal Poly's fate did not, however, deter the other state colleges form making similar efforts.

In February 1952, the Council of State College Presidents proposed conferring master's degrees in fields other than teaching. Although the discipline under discussion was engineering, the energy and animus from both sides suggest that more was at stake than just which institutions could offer master's degrees in engineering. In a letter to James Enochs, Specialist in State College Curricula, Dudley Robinson (from the physical sciences of San Diego State) suggested, "We are concerned with engineering at the moment but tomorrow some other departments may be in the same position. If the University can manipulate itself into control of committees and procedures it can and will have absolute control of all phases of the State College programs."[39]

The Liaison Committee commissioned two studies, each the responsibility of a prominent dean of engineering—A. A. Potter of Purdue University, and Fred Terman of Stanford. Sounding like O'Brien and

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[35] G. M. Butler to C. E. Knott, 22 Nov. 1949, McPhee Papers, "Accreditation" folder, Cal Poly San Luis Obispo Archives [hereafter, CPSLO Archives].

[36] Cited from Cal Poly SLO electrical engineering web page history, "Accreditation for the Department," copyright 2008.

[37] C. E. Davies to C. E. Knott, 20 Oct. 1950, McPhee Papers, "Accreditation" folder, CPSLO Archives.

[38] Cited from Cal Poly SLO electrical engineering web page history, "Accreditation for the Department," copyright 2008.

[39] Robinson to Enochs, 15 Oct. 1952, MC 194 binder labeled "HISTORICAL DATA Mtg. UCLA."

Boelter, Potter concluded that California "will need no engineering colleges in addition to those accredited by [the ECPD]—no state can afford to waste money." By contrast, Terman warned of a "serious shortage of engineers—[California should fund] expansion programs of engineering at state colleges." In February 1953, the Regents and the Board of Education unanimously approved the Liaison Committee's recommendations. The so-called Engineering Agreement rejected efforts by the state colleges to conduct engineering research and to offer master's degrees in engineering, and recommended that ECPD accreditation not be sought.[40] So just as with the 1948 Strayer Report, the Engineering Agreement reaffirmed much of UC's position.

Yet if other developments since 1948 were any indication, UC's administrators had cause to worry. The Board of Education's benign neglect of the state colleges could explain why, as of fall 1952, although 314 engineering courses were listed in the catalogues of Cal Poly, San Diego, Fresno, and San Jose State colleges, and nearly 2,000 students were enrolled in those engineering programs, none of them had been approved by the state Board of Education.[41] While the Strayer Report had opposed future development in engineering programs until a sufficient demand was demonstrated, in the four years following the report San Jose State had expanded from eight instructors to twenty-one, and from nineteen upper-division courses to forty-one.[42] The University of California kept winning battles but, O'Brien believed, it was losing the war.

The Demand for Engineering Education

Heat generated by the intramural struggle between the University of California and the state colleges might have remained out of the public view if not for developments in Santa Clara Valley, which would later become the heart of Silicon Valley. By the early 1950s, the area featured local high-tech firms such as Hewlett-Packard and Varian Associates. The region's big high-tech growth in the 1950s would, however, come from branches of multilocational firms based elsewhere.[43] Indeed, when Stanford engineering dean Frederick Terman attempted to establish a "community of technical scholars" around the university, he focused on

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[40] Thomas Holy, "Memorandum on Engineering Education in the California State Colleges and the University of California, July 11, 1958," CU-149, box 40, folder 31.

[41] T. C. Holy and H. H. Semans, "Certain Information in Engineering Programs in the California State Programs and the University of California (Fall Semester 1952), Dec. 8, 1952," MC 194 folder titled "Historical Data—State Eng. Mtg re UC Controversy," SJS Archives; O'Brien to Sproul, 17 Dec. 1952, CU-5, series 4, box 16, folder 3, "Engineering in State Colleges 1948-1952."

[42] O'Brien to Sproul, 17 Dec. 1952.

[43] Stephen B. Adams, "Growing Where You Are Planted: Exogenous Firms and the Seeding of Silicon Valley," *Research Policy* 40, no. 3 (2011): 368-79.

established firms more than on start-ups. After all, in the years immediately following World War II, Stanford still faced a budget crisis that began during the Great Depression. Therefore, Stanford's relationships with industry were primarily aimed at raising money. So when the university established Stanford Industrial Park in 1951, it was a way, according to president Wallace Sterling, of "putting idle lands to work."[44]

This mattered little to the University of California and the state colleges until 1953, when Terman informally began a program aimed at providing engineering graduate training and degrees for employees of local firms—some of which had set up shop in Stanford Industrial Park. Terman, a master of supply and demand for academic services, made sure that the Honors Cooperative Program (HCP) would grow, but not too much, reinforcing the program's selectivity. It turned out that the primary demand for HCP was by branches of firms headquartered elsewhere, firms with the resources to pay for tuition. Some firms had an insufficient number of slots in the program to meet employee demand, and others were left out of HCP entirely.[45]

Some firms responded to Stanford's restrictions on supply by seeking alternatives. One option they pursued was asking for a geographic expansion by the Bay Area's other premier engineering program, UC Berkeley. In October 1954 (a month after Stanford formally launched the HCP) and again in April 1955, representatives of Food Machinery Corporation (FMC) and IBM asked Dean O'Brien to provide an extension program to meet the demand that Stanford did not. "We [compete] with other concerns in the Eastern Area and Southern California area [that are luring engineers to their companies by such means as advance educational opportunities," wrote FMC's Jack Hait. "Unless we are able to provide such comparable opportunities for men coming to our area, we will find ourselves in an even more untenable situation so far as recruiting technical personnel is concerned."[46] O'Brien responded that "we could not be so awkward as to fail to offer" such a program.[47]

Administrators at the University of California had little incentive, however, to devote attention or resources to creating a program an hour away from Berkeley. The proposal moved ever so slowly from the engineering school to the graduate division to the chancellor to the president (without resolution) during the next three years. The local public college (San Jose State) could do nothing to help, because state colleges were not allowed to offer master's degrees in engineering—a restriction UC insisted upon. In addition, some of the Valley's big employers, who were based in the East, did not reimburse their employees for education at

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[44] Stephen B. Adams, "Stanford and Silicon Valley: Lessons on Becoming a High-Tech Region," *California Management Review* 48 (Fall 2005): 29-51.

[45] Adams, "Follow the Money," 384-85.

[46] Hait to Meriam, 13 April 1955, CU-5, series 3, box 17, folder 2.

[47] O'Brien to Kerr, 21 April 1955, CU-149, box 40, folder 5.

unaccredited institutions. Engineering at San Jose State, as at the other state colleges, was not accredited—another restriction UC insisted upon. So UC made a twofold response to industry's request from Santa Clara Valley: a concerted dragging of feet combined with actions that resulted in San Jose State's inability to meet the need.

The difficulties in obtaining permission to provide a graduate program and to seek accreditation caused Ralph Smith to resign as the head of San Jose State's engineering program in early 1956 and to accept an offer from Fred Terman to join the faculty at Stanford.[48] When Smith left, San Jose State was having related troubles in meeting the needs of a growing student body. In the mid-1950s, the Board of Education set enrollment limits of 5,000 for each of the state college campuses. By then, however, San Jose State had already surpassed 10,000. In engineering, increased demand resulted in a shortage of teachers. San Jose's program could not attract the Ph.D.'s it needed as faculty, partly because the program was not accredited and did not offer a master's degree. In November 1956, San Jose State's engineering program hosted a college-industry luncheon for local employers to enlist their help. The timing was good; a few months earlier, local companies had formed the Santa Clara Valley Joint Council on Science and Mathematics Education to stimulate interest in those subjects among junior high and high school students.

Norm Gunderson, who had succeeded Ralph Smith as head of engineering, explained to San Jose State president John Wahlquist that "the purpose of the luncheon was to acquaint leaders of industry and government agencies in this area with the problem of obtaining sufficient qualified instructors to staff our growing program; we indicated that we would very possibly be calling upon them for the release of their engineers on a part time basis."[49] After a discussion of San Jose's staffing needs, questions ensued regarding the scope of San Jose's program and a discussion of the Engineering Agreement of 1953. "The part of the agreement that specifies that our curricula shall be so designed that they are not accreditable by the Engineering Council for Professional Development is especially troublesome to professional engineers," wrote Gunderson. "To them, this implies that we are intended to be sub-standard. Those in attendance were most concerned and asked what steps might be taken to correct this part of the agreement." Representatives of twenty-four companies and agencies entered the room as possible suppliers of faculty, and many left as advocates on behalf of the program. The Joint Council established a committee with the goal of allowing state

[48] Norm Gunderson oral history, p. 21, LD 729.6 S4 G86 1987, SJS Archives.

[49] Gunderson to Wahlquist, 25 June 1957, MC 193, unlabeled binder, SJS Archives.

college engineering programs to seek accreditation from the ECPD and to offer master's programs.[50]

Ironically, the key industry players in this drama involving California higher education policy proved to be companies headquartered in the East. In July 1957, representatives of Westinghouse, GE, and IBM, acting as representatives of the Joint Council, wrote to assemblyman Bruce Allen (whose district included much of Santa Clara County) to enlist his assistance in getting permission for San Jose State's engineering program to seek accreditation. The firms cited five problems that accreditation of San Jose State's program would help address:

1. San Jose State's difficulty in recruiting faculty;
2. Difficulties of local firms in recruiting (if prospective employees wanted to seek graduate degrees);
3. Limits on professional possibilities for San Jose State grads;
4. Limits to the eligibility of San Jose State students for scholarships; and
5. Limits on grants by industries and government to San Jose State.[51]

Allen's support proved to be a dream come true for San Jose State and a nightmare for UC Berkeley. Although nominally of split allegiances (with an undergraduate degree from San Jose State and law degree from Cal's Boalt Hall), Allen was offended by UC's intransigence and sympathetic to San Jose State's efforts to serve his constituents. In early August, within two weeks of receiving the letter from representatives of the Joint Council, Allen wrote to the Board of Regents and the governor, calling the current use of the 1953 Engineering Agreement "vicious," noting that the accreditation prohibition would "keep [state college] engineering departments at a second rate level," and asking how his constituents could pursue master's degrees in engineering.[52]

Bruce Allen's involvement, and the escalation of discussion of the new program to the governor's office, focused a number of minds at the University of California. President Sproul solicited feedback from his staff and administrators on what do about Allen's letter. Paul H. Sheats, who had become director of UC extension in 1956, acknowledged that the ground had shifted: "Allen's letter brings the matter to a head." Sheats sensed that how UC handled the program in question could have domino-type implications far beyond engineering: "We shall have to concede and recognize that accreditation of state colleges for engineering degrees will be followed, and soon, with similar demands for graduate programs in other professional fields." He also suggested that the geographic source of

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[50] M. D. McDowell to Gunderson, 28 June 1957, MC 193, unlabeled binder, SJS Archives.

[51] McDowell, Hubin, and Luther to Allen, 23 July 1957, MC 193, unlabeled binder, SJS Archives.

[52] Allen to Boelter, 5 Aug. 1957, CU-149, box 40, folder 31.

grievance was significant: "The critical pressure from the Santa Clara Valley should be recognized as only a forerunner of similar demands in other fields and from other sections as the industrial plant triples or quadruples in the next ten years." Sheats's prescription: agreeing to provide this modest program in Santa Clara County could render the ambitions of San Jose State (and, presumably, other state colleges) in engineering moot. "If the University is willing to meet demonstrated needs for which it is assigned responsibility," he wrote, "what is the logic of a proposal to make state colleges into universities?"[53]

The University of California began to consider adding campuses in the late 1950s, and one of the planned locations was the south central coast. In their August 1957 meeting, the UC Regents agreed that San Jose would be a likely location for a new UC campus. From 1957 until 1960, the leading candidate to host a new campus there was San Jose. Therefore, when UC dealt with Bruce Allen and others regarding master's programs in engineering, the goal was to buy time, to fend off efforts by San Jose State to expand its scope until the new campus could meet local needs.

That did not, however, ease pressure to change the rules regarding San Jose State's engineering program. At the same Conference on Educational Policy of the University of California, regent Donald McLaughlin, who had preceded O'Brien as Cal's engineering dean, argued that the "problem of engineering" showed that the division of labor among the junior colleges, the state colleges, and the University "needed better definition."[54] This was essentially a call for a California Master Plan of Higher Education. A year later, when UC's new president, Clark Kerr, convened the first informal meeting that led to the creation of the Master Plan, McLaughlin's point of view would matter a good deal: by then, he would be chairman of the Board of Regents.

In September, Allen and representatives of San Jose State, Westinghouse, General Electric, and IBM presented their case to the Board of Education. This led the Liaison Committee to order the Joint Staff to reexamine the Engineering Agreement. The Soviet launch of Sputnik in October 1957 only intensified the pressure that Allen helped bring to bear on the UC Regents and the California Board of Education. From 1947 to 1957, California state employment had increased by 40 percent, and defense-related industry had accounted for about half the increase.[55] Engineering education in Santa Clara Valley was an issue not just of economic development but also of national security.

In October 1957, Allen visited the UC president's office, where he met with vice-president Stan McCaffrey. McCaffrey later informed President

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[53] Sheets to Robb, 26 Aug. 1957, CU-5, series 4, box 16, folder 5.

[54] Conference on Educational Policy, 14 Aug. 1957, CU-5, series 4, box 16, folder 5.

[55] Douglass, *The California Idea*, 233; Robert K. Arnold, et al., *The California Economy, 1947-1980* (Menlo Park, Calif., 1960), 55, 61.

Sproul that Allen "stated he was hopeful that the University might be able to provide engineering graduate education in the near future in the Santa Clara Valley area, noting that Stanford, which had previously provided some graduate study, was cutting down on the amount of such work they were now offering." While acknowledging his hopes for a UC campus in Santa Clara Valley "which would offer engineering," Allen pointed out that it might be several years before such a program was in place. Therefore, Allen "felt it necessary that San Jose State be allowed to improve their engineering course so that it could be accredited and that very possibly they should be allowed to give graduate work, if the University did not meet that need in the relatively near future." McCaffrey supplied an answer to Sproul that UC would support for the next year and a half: if the university acted quickly to establish a master's-level engineering program in Santa Clara Valley, it might "sidetrack efforts by the state colleges to do so."[56]

In November, the West Coast Electrical Manufacturers Association (WCEMA) issued a statement on "The Topic of Engineering Education at San Jose State College." The WCEMA had its roots in an effort during World War II by indigenous local firms to garner a greater share of defense contracts for Santa Clara County and San Mateo County.[57] In subsequent years, WCEMA had softened its anti-eastern attitude and embraced branches of eastern firms as members. The problem that the fifty member companies of WCEMA faced was that

> the existing avenues for engineering study are not now meeting the demand and unless there is a drastic change in the situation, they will not do so in the future. A new campus of the University of California would in some measure ease the situation 10 years from now, but by all estimates the demand will have reached such proportions that additional facilities would again be needed. In the meantime, or if a full scale engineering campus of the University of California is not established, the lack of adequate accredited engineering facilities in the San Jose area will result in a curtailment of the growth of an industry that is vital in the picture of our national defense today.

The statement concluded with a call for San Jose State's engineering program to be allowed to seek accreditation and to offer master's degrees.[58]

In 1954 and 1955, UC's administrators had viewed the requests from local business for a graduate program in engineering as a distraction from what the university ordinarily did. By the fall of 1957, UC representatives

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[56] McCaffrey to Sproul, 14 Oct. 1957, CU-5, series 4, box 16, folder 5.

[57] Stephen B. Adams, "Regionalism in Stanford's Contribution to the Rise of Silicon Valley," *Enterprise & Society* 4 (Sept. 2003): 521-43; AnnaLee Saxenian, "Contrasting Patterns of Business Organization in Silicon Valley," *Environment and Planning D: Society and Space* 10 (1992): 377-91.

[58] Westburg Statement, 14 Nov. 1957, MC 193, unlabeled binder, SJS Archives.

recognized that such a program could act as a place holder to fend off San Jose State's ambitions until the new campus was built. That might represent the best possible tactic toward the desired end of blocking the expansion of scope by the state colleges in engineering. During this period, however, the attitude of a key person had changed. In 1954 and 1955, Dean O'Brien had reassured local businesses that the University of California would meet their needs—and had acted as a public advocate on their behalf.[59] By 1956, however, O'Brien had become the loudest voice against doing so—to the distress of the UC administration.[60]

After Bruce Allen's August wake-up call, O'Brien did not shift with the rest of the UC administrators toward helping erect a temporary gate to hold out the barbarians from the state colleges. Instead, he suggested that UC need not serve the employers in Santa Clara County because apparently demand did not justify the proposed program. In late October, O'Brien wrote to Sproul: "I expect that by June of 1958, there will again be talk of an oversupply of engineering graduates. . . . I fear that the public reaction is likely to produce another unsound shift of emphasis and support for education in this field."[61]

O'Brien's delicate position was summed up by a Sproul staffer in a November 1957 letter to his boss. "All of us (Messrs McCaffrey, Corley, Holy, Dabagh, Leach; also Harold Walt and Admiral Singleton) who have become acquainted with the San Jose problem hope that Dean O'Brien can be persuaded to give his blessing to the establishment by University Extension of an off-campus graduate program in Engineering in San Jose," he wrote, "even if it should accomplish no more than prove to the satisfaction of the local pressure groups, as Dean O'Brien asserts, that need for such instruction has been exaggerated." Johnson also acknowledged the consequences of not offering the program: "Otherwise, we believe, the pressure for authorization of a graduate engineering program by San Jose State College will prove irresistible, adding greatly to the problems of the University when it attempts to develop its own program on the new campus projected for the area."[62] T. R. McConnell, of the UC Berkeley School of Education, noted that this case "raises the fundamental issue of whether one division of the university is to take action which may be detrimental to the future development of the institution as a whole."[63] Kerr's later actions regarding O'Brien suggest that he shared McConnell's concerns.

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[59] Minutes of Engineering Council, 21 May 1955, CU-5, series 3, box 17, folder 6 (3).

[60] Minutes, Graduate Council, 11 March 1957, CU-5, series 3, box 17, folder 6 (2); O'Brien to Kerr, 11 March 1958, CU-149, box 40, folder 5.

[61] O'Brien to Sproul, 29 Oct. 1957, CU-5, series 4, box 16, folder 5.

[62] Johnson to Sproul, 8 Nov. 1957, CU-5, series 4, box 16, folder 4.

[63] McConnell to Kerr, 13 Nov. 1957, CU-149, box 40, folder 31.

In March 1958, Allen wrote to Governor Knight regarding the situation in the Valley. Writing during a peak of Cold War tension, five months after the Soviets launched Sputnik, Allen emphasized that the "several thousand" local engineers from the petitioning companies were involved in activities crucial to national defense, such as the Polaris missile program. "The problem becomes acute," wrote Allen,

> not by the unwillingness of the University to offer more in the way of service, but by the apparent opposition of the University to allowing anyone else to perform this service. . . . [I]t has become quite apparent that University politics are preventing San Jose State College from offering the service the University declines to give and which is needed to maintain and continue a great industry in my own county.[64]

UC was being not just recalcitrant but unpatriotic.

Allen introduced a bill in the state legislature that would empower the Board of Education to establish engineering master's degree programs in the state colleges. By April 1958, the handwriting on the wall was clearly legible to Thomas C. Holy, who had represented the University of California on the Joint Staff of the Liaison Committee, and would be on the Master Plan Survey Committee: "You have heard it said that the two certainties in life are death and taxes," he wrote to Sproul. "To that I think we may well add a third; that if the university does not move promptly in implementing [the proposed off-campus graduate engineering program near San Jose], the state colleges are going to be in the graduate field in engineering."[65]

In April 1958, the Joint Staff of the Liaison Committee issued a recommendation that the state colleges be allowed to seek accreditation but not allowed to offer graduate programs. By May, the Regents and the Board of Education had approved that recommendation, which also suggested that UC provide a graduate engineering program in Santa Clara Valley. From then on, UC administrators, with the exception of O'Brien, would be steadfast in support of the creation of UC's graduate engineering program in Santa Clara Valley. Were they simply ignoring what was obvious to O'Brien—a lack of demand for the program?

In 1958, surveys of Santa Clara Valley employers indicated much interest in master's programs in engineering. Southern California–based Lockheed, which had moved its Missiles and Space Division to Sunnyvale in 1956, estimated that nearly three hundred "of our technical people would want to take graduate courses for an advanced degree early in 1959."[66] Three months later, the West Coast Electronic Manufacturing Association reported that "our latest survey indicates that there are at least 461 employees of WCEMA companies who would like to pursue graduate

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[64] Allen to Knight, 10 March 1958, CU-5, series 2: 1957 (folder 4).

[65] Holy to Sproul, 7 April 1958, CU-5, series 4, box 16, folder 5.

[66] Root to Holy, 6 March 1958, MC 193, unlabeled binder, SJS Archives.

study." The number was likely conservative, according to the report, because "since the survey was conducted, one company [Lockheed], which employs a very high percentage of engineers, has grown three-fold, to over 10,000 employees."[67]

One group that had not been a major part of these discussions at UC had been the engineering faculty.[68] In May 1958, they informed Chancellor Kerr that they were not interested in teaching courses an hour away from campus unless they received double credit for the courses. Kerr was sympathetic, but he was chancellor of a campus in a system, not an independent entity. When he learned that UCLA did not offer double credit for off-campus teaching, he refused to set a contradictory precedent. Siding with the faculty, in July O'Brien unilaterally stopped work on establishment of the off-campus program. Kerr, who had been installed as UC president in July, accused O'Brien of "gross insubordination, in the light of your knowledge of how important this matter is to the University" and ordered that the program move forward (even though Kerr himself had publicly expressed major doubts about it as early as 1954 and as late as April 1958).[69]

This one act by O'Brien, more than any other, would cost him his deanship—an indication of how much Kerr and other UC administrators thought was at stake. Just weeks into his new job as president of the University of California, Kerr made his priorities clear:

> It is a matter of the greatest concern and consequence to the University that the principle of differential functions between the state colleges and the University be preserved. Were the master's degree in engineering to be authorized for state colleges, this breeching of the principle would open the way for other graduate offerings, thereby subverting the policy formulated in the Strayer Report and reaffirmed in *A Restudy of the Needs of California in Higher Education*.[70]

Under pressure from Kerr and other administration officials, O'Brien resigned as dean in the fall of 1958.[71] It must have been little consolation to O'Brien that the new program never amounted to much: seven students finished one course in the fall of 1958, and nine enrolled the following spring.[72]

How did local companies so greatly overestimate demand for a part-time master's program in engineering? In fact, they did not. In the fall of

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[67] LaFitte to Gunderson, 3 June 1958, MC 193, unlabeled binder, SJS Archives.

[68] O'Brien to Sproul, 28 Feb. 1958, CU-5, series 3, box 17, folder 6 (1).

[69] Kerr to O'Brien, 25 July 1958, CU-149, box 40, folder 31; "Confidential off-campus Graduate Instruction Engineers," 14 July 1958, CU-149, box 40, folder 5.

[70] Kerr to O'Brien, 25 July 1958, CU-149, box 40, folder 31.

[71] Kerr to O'Brien, 21 Nov. 1958, CU-5, series 8, box 76, folder 14; Strong to Seaborg, 27 Oct. 1958, CU-149, box 40, folder 23.

[72] B. Bresler to O'Brien, 20 Feb. 1959, CU-149, box 40, folder 5.

1959, the accredited engineering program at the University of Santa Clara, which had been approached by IBM about such a program years before, launched an "early bird" graduate engineering program, in which each class met from 7:00 until 9:00 in the morning once a week.[73] By 1963, the new program had more than six hundred students, about 30 percent above the WCEMA's 1958 estimates for demand.[74] Poor turnout for the University of California's 1958-1959 program, in contrast, was likely a reflection of Cal's pro forma effort—poorly promoted, little faculty interest, last-minute money from the state—and no commitment for permanent facilities.[75] In the spring of 1959, shortly after San Jose State received approval for a master's program in engineering, Cal announced the demise of its master's program in Santa Clara County.

Engineering at San Jose State had come a long way since 1951, when it was a non-accredited undergraduate program boasting ten faculty members in quonset huts. During this period, the number of upper-division engineering majors at San Jose State increased from about a hundred to five times that. San Jose State's growth in engineering was a reflection of broader growth in the state college system. In 1950, only 7 percent of public master's degrees were from the state colleges. By 1957, more than 50 percent were.[76] Little wonder that one month after O'Brien's "insubordination," Kerr would host the first informal meeting on creation of a Master Plan. San Jose State, which had become a program of forty-three faculty members in a modern building about to establish a graduate program, would receive accreditation in civil and electrical engineering in December 1959—about the time the Master Plan team completed its work.[77]

Conclusion

The battle over the role of California's state colleges and the conflict's final focus on engineering education can be viewed in the context of a development beginning to take off in the 1950s: the rise of the knowledge economy. It was during the final ten years before the implementation of the Master Plan that engineering and the sciences became central

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[73] Boelter to Sproul, 2 Aug. 1955, CU-5, series 3, box 17, folder 6 (3).

[74] "The Second Decade of Achievement," p. 22, School of Engineering, 1968, classification no. 23DB2, box 2 of 2, accession no. 984-004, Office Files: Dean, School of Engineering, SCU Archives.

[75] Minutes, Committee on Educational Policy, 16 April 1959, CU-5, series 8, box 76, folder 10; "Minutes, Chancellor's Administrative Advisory Council," 30 April 1958, CU-149, box 40, folder 5; C. Tod Singleton, Jr., to O'Brien, 11 April 1958, CU-5, series 3, box 17, folder 2; Minutes, Regents of the University of California, 20 June 1958, CU-149, box 40, folder 5.

[76] Smelser, "Growth, Structural Change," 52-53.

[77] Norman Gunderson, "Division of Engineering between 1951-52 and 1961-62," MC 193, binder labeled "GSBA Eng. . . 1956-1968," SJS Archives.

elements in the third mission of the university: regional economic development. Local business's grievance that Assemblyman Allen responded to—the threat to economic development posed by an inadequate supply of engineering higher education—was real, but it was also new. In subsequent years, several high-tech clusters would develop in the United States, most of which would be anchored by academic institutions with superior programs in engineering or the sciences.

One of the lessons that Clark Kerr learned from this episode was that a centerpiece of the "multiversity" should be the regional promotion of what Kerr called the "knowledge industry." As the University of California expanded to include campuses in Santa Cruz (rather than San Jose) and Irvine, Kerr set out to provide each campus with an engineering program. This became a problem when it was pointed out in 1968 to Kerr's successor, Charles Hitch, that an engineering program on each campus would result in supply outstripping demand in the state. The result was that engineering programs that had been authorized for UC Riverside and UC Santa Cruz were discontinued by the following year. And the individual making that point, ironically, was none other than Fred Terman, dean emeritus of engineering at Stanford.[78]

Although Kerr overreached in engineering, his fundamental principle was sound: that the university could represent a fundamental engine of high-tech economic growth. University engineering programs would anchor high-tech regions around the country. Silicon Valley would become the nation's foremost high-tech region in no small part because of the proximity of two top-tier engineering schools (Cal and Stanford). Indeed, to the extent that scholarship of America's two foremost high-tech clusters (Silicon Valley and Route 128) has credited higher education, the focus has been on elite research institutions (Stanford and UC Berkeley; MIT and Harvard).[79]

Yet there is another story, which relates to the role of external forces in California public higher education. What Clark Kerr and the others at UC may have missed at the time was something that Fred Terman was conscious of: the division of labor among various tiers of engineering schools. Stanford emphasized the production of Ph.D.'s to such an extent that it could never independently support a high-tech region's needs for an educated workforce. The subsequent development of Silicon Valley would require a workforce educated by San Jose State and Santa Clara Univer-

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[78] Hitch to Knorr, 5 Sept. 1968, CU-5, series 8, box 76, folder 11.

[79] AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, Mass., 1996); Leslie, *The Cold War and American Science*; Henry Etzkowitz, *MIT and the Rise of Entrepreneurial Science* (New York, 2002); Margaret Pugh O'Mara, *Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley* (Princeton, N.J., 2005); Martin Kenney, ed., *Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region* (Stanford, Calif., 2000); Edward B. Roberts, *Entrepreneurs in High Technology: Lessons from MIT and Beyond* (New York, 1991).

sity, as well as by Stanford and UC Berkeley. San Jose State has provided Silicon Valley more engineers than any other university, and the Santa Clara University's "early bird" program almost immediately became an important institution for upward mobility in the Valley. This all began with requests to the University of California by big business; the impact of requests from a few multi-locational firms continues to be seen more than fifty years later. San Jose State's engineering program, with all of the assistance it received from Stanford, could be viewed as one of the most consequential spin-offs from a very entrepreneurial university.